Olaf Klein

Modeling and Numerical simulation of the application of traveling magnetic fields to stabilize crystal growth from the melt

This talk deals with the mathematical modeling and simulation of crystal growth processes of the so-called *Czochralski type*. These are important industrial processes to grow large bulk single crystals of semiconductor materials from the melt.
A recently developed technology in which *traveling magnetic fields (TMF's)* are applied in order to control the behavior of the turbulent melt flow will a investigated.
Since numerous different physical effects like electromagnetic fields, turbulent melt flows, high temperatures, heat transfer via radiation, etc., play an important role in the process. Hence, for considering the real-life growth scenarios, one has to deal with an extremely difficult system of initial-boundary value problems for nonlinearly coupled partial differential equations.
An brief overview of mathematical results for this model obtained for it in recent years will be presented and the numerical implementation of the model will be discussed.
Moreover, numerical simulations of liquid encapsulated Czochralski (LEC) crystal growth of GaAs will be presented, showing the stabilizing influence of the Lorentz force on the melt.
This talk presents results of joined works with P.-É. Druet, J. Sprekels of the Weierstrass Institute for Applied Analysis and Stochastics (WIAS); Ch. Lechner of the Vienna University of Technology; P. Philip of the Department of Mathematics, Ludwig-Maximilians University (LMU) Munich; Ch. Frank-Rotsch, F.-M. Kießling, W. Miller, U. Rehse, P. Rudolph of the Institute of Crystal Growth (IKZ).
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